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# Impact of Botanical Extracts on Weight Gain and Abdominal Fat Content in Broiler Chickens

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**Abstract**

The aim of this study was to examine the effects of four levels of a botanical extract, Phyt$^{\text{Exponent®}}$ (PE), on growth performance of broiler chickens and accumulation of abdominal fat. A total of 125 Ross day-old broiler chickens were randomly divided into 5 treatments, with 5 birds in each. Treatments included: control (basal diet and water without PE 0.005, 0.001, 0.015 and .002% PE in drinking water. PE was given twice a week in the first three weeks only. Water and feed were provided *ad libitum* throughout the study. In this experiment, broilers, which had 0.02% PE had highest, body weight, but control group had lowest body weight ($P < 0.001$). Birds that received 0.005%PE had minimum body weight in first week ($P < 0.05$). Feed intake between treatments was similar and not significantly different between treatments throughout the 42-day period. At age 42, the abdominal fat content was significantly high in the control group (and low in the treatments ($P<0.001$). Mortality occurred only in the control treatment only ($P<0.0001$). Total abdominal body fat was inversely proportional to the concentration of PE. The present results indicated that administration of medicinal plant extracts in chicken improves growth performance, FCR, water intake, reduced mortality and abdominal fat broiler chickens.

***Keywords:*** mortality; immune booster; tolerance; poultry.

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## 1. Introduction

Poultry production is increasingly growing on large and small-scale production due to the growing demand for poultry products (meat, eggs and manure). Due to escalating prices of beef and pork, consumers are resorting to poultry products because of their relatively low prices. Poultry is considered the best source of protein in the category of white meats with a lot of people being advised to consume it more than red meat for health reasons. It is upon this background that the major goals of the poultry industry are to increase the carcass yield and to reduce carcass fatness, mainly the abdominal fat pad. The abdominal fat tissue is crucial in poultry because it grows faster compared with other fat tissues [1]. The abdominal fat pad is a reliable parameter for judging total body fat content because it is linked directly to total body fat content in avian species [2, 3]. The increase in poultry meat consumption has guided the selection process toward fast-growing broilers with a reduced feed conversion ratio. However producers are faced with problems of broilers that have a high fat content especially on the abdominal pad. Intensive selection has led to great improvements in economic traits such as body weight gain, feed efficiency, and breast yield to meet the demands of consumers, but modern commercial chickens exhibit excessive fat accumulation in the abdomen area. However, dietary composition and feeding strategies may offer practical and efficient solutions for reducing body fat deposition and improved growth performance in modern poultry strains. Thus, the regulation of lipid metabolism to reduce the abdominal fat content based on dietary composition and feeding strategy, should be of high priority in designing chicken feeding regimes.

To reduce mortality poultry suppliers vaccinate their flocks against the most economically important diseases but they advise farmers to consult them and veterinary experts on further vaccination recommendations due to incidence of disease developing in the vaccinated fowls. Diseases incidence occurs due to various reasons spanning from improper sanitary condition and spread of disease inoculum. Chickens, like other fowls, are prone to infectious bursal disease (IBD) or Gumboro, New Castle disease, ND, Infectious bronchitis (IB) and coccidiossis, among others. Chickens that are attacked by disease usually have their immune system compromised and unable to suppress development of the disease. Poultry diseases lead to high cost of production leading to losses by producers. Consumer health is at risk due to antimicrobials used in animal production, for instance, [4] noted that the use of antibiotics in dairy cows led to antibiotic resistance in milk consumers.

Antimicrobials are delivered to animals for a variety of reasons, including disease treatment, prevention, control, and growth promotion/feed efficiency. Antimicrobial growth promotants (AGPs) were first advocated in the mid-1950s and for many years been used in very small quantities to improve animal health. However, continued use has saw detrimental effects on human health due to presence of resistant strains of pathogens in the food animals that transferred to the consumers, for example, tetracycline-resistant and other drug-resistant *Escherichia coli* strains were found in chickens and a subsequent acquisition of resistance in *E. coli* in the intestinal flora of the consumers [5]. This has resulted in the ban of a number of synthetic antimicrobial substance and paving way to incorporation of phytogenic substances in poultry feeding regimes.

Phytogenic substances, also known as botanicals, have immune-stimulatory effects that not only reduce or alleviate disease incidence in poultry flocks but also improve on meat quality [6,7, 8,9]. These substances used alone or in combination, have been incorporated in animal diets to prevent diseases and improve on carcass quality and milk production [10], albeit with variable results depending on the severity of the pathogen and stage of administration.

The use of a cocktail of botanical extracts that boosts the immunity among other physiological processes can improve on a number of desirable market attributes but the main one being ability to resist or suppress disease causing pathogens resulting in low mortality and improved rate of weight gain [11] and reduction in fat content. Although herbal remedies have a long history of use among livestock owners [12, 13] there is a wide opinion that plant remedies should be regarded with scepticism because the efficacy of many have not been proven or documented. This project seeks to assess the impact of a cocktail of botanical extracts on weight gain and incidence of disease in broiler chickens reared from day 1 to 6 weeks. The cocktail of botanical extracts is Phyt Exponent®, an alcoholic extract of a mixture of herbs preserved in 62% alcohol to increase shelf life. Each 5ml of the cocktail includes extracts of garlic (*Allium sativum* (10µl), *Triticum repens* (70µl), *Viola triocolor* (70µl) *Matricaria chalmomilla* (85µl) and *Echinachea purpurea* (30µl). This concoction is given at a very low dose making it cost effective. PE is entirely based on plant extracts and is therefore a natural product used to support not only recovery of the immune system but to improve on the growth performance and meat quality in livestock. It has healing effects on different target organs and therefore prevents mortality.

This study seeks to i) to assess the ability of a cocktail of botanical extracts in improving weight gain and disease tolerance in broiler chickens**,** ii) determine the most suitable botanical concentration that can promote growth rate without causing mortality or deformity in broiler chickens and iii) determine the abdominal fat content in the chickens and correlate it to final body weight.

## 2. Methods and Materials

A total of 125-mixed day old Ross broiler chicks were obtained from a local supplier, Novatek® and the experiment was carried out in Bindura, Zimbabwe (17.3033°S; 31.3225°E; 1118m). The chicks were according to the supplier, already vaccinated against diseases such as IBD, ND and IB. The chicks were weighed upon arrival and randomly assigned to five treatments (Table 1) in groups of five per cage (0.5mx0.5mx1m) replicated five times. Initially the chicks were given 5% sugar solution upon arrival.

**Table 1:** Random treatments based on per cent Phyt Exponent® to which chicks were assigned upon arrival and maintained throughout the experiments

| Treatment | % Phyt Exponent® |
|---|---|
| **0** | 0 |
| **1** | 0.5 |
| **2** | 1.0 |
| **3** | 1.5 |
| **4** | 2.0 |

Treated water was administered to chicken as their first drink in the morning and then normal or untreated water for the rest of the day. In week 1, treated water was given at day 3 and day 6 so that the chicks had 200ml treated water per week. In week 2 the chicks were given treated water on day 10 and 13 and in week 3, on day 17 and 20. Thereafter the chickens were fed normal water and food until day 42.

Feed and water were given *ad libitum* throughout the 42-day period except for the 100ml treated water in specified days to treatment groups.

Chickens were checked for any diseases and mortality on a daily basis and any mortality recorded.

Using and electronic balance (Kerro BL10002), the body mass of chickens was measured on a weekly basis for six weeks however the final body mass was used for data analyses.

Abdominal fat measurements were taken on the 125 broiler chickens using modified callipers [14] to determine the prediction of abdominal fat at 42 days of age.

Broilers were slaughtered on day 43 after eight hours without food but water was given. The starved weights of chickens were measured and recorded at the time of slaughter.

The chickens were slaughtered according to treatments and their abdominal fat measured individually. The abdominal fat included the leaf fat from the cloacal region and gizzard fat. Leaf fat was taken from the area around the cloaca and the viscera while gizzard fat was taken from the area between the gizzard and the duodenum. After removal, the fat weights were measured using an electronic balance (Kerro BL10002).

The fat measurements were significantly related to the proportion of abdominal fat (*g* abdominal fat/kg body weight) of the birds. Statistical analyses were done using R statistical software.

The relative reduction in abdominal body fat was calculated using the equation:

**% Reduction in body fat = (control body fat– treatment body fat/control body fat)*100**

## 3. Results

The control treatment had the highest mortality and no mortality was observed in chickens given 1%, 1.5% and 2% PE (df=4; F= 5.341 and P<0.01). There was marginal significant difference in the control and those chickens given 0.5%PE ((P=0.04).

Phyt$^{\text{Exponent®}}$ variably reduced the total abdominal fat and body mass in broiler chickens (Table 2).

A 0.005% PE did not significantly change the total abdominal fat content but significant reduction in fat was evident at 0.015 and 0.02% PE.

The final weight of chickens just before slaughter significantly differed between all treatments (df=4; F=319 and p<0.001). The amount of PE given was directly proportional to the final weight of the chickens with the highest mean mass obtained with the highest PE dose without any side effects.

**Table 2:** Effect of various amounts of Phyt$^{Exponent®}$ in reducing the total abdominal fat content and body mass on Ross broiler chickens

| **Treatment (%PE)** | **Total abdominal fat mass (*g*)** | **% Reduction** | **Significance** | **Final Body mass (*g*)** | **% Increase** | **Significance** |
|---|---|---|---|---|---|---|
| **0 (Control)** | 121.9 | - | - | 1981.3 | - | - |
| **0.005 (Lo)** | 117.5 | 3.6 | 0.52 | 2222.6 | 12.6 | * |
| **0.010 (Med)** | 98.8 | 18.9 | ** | 2428.2 | 22.6 | ** |
| **0.015 (Hi)** | 70.2 | 42.4 | *** | 2592.1 | 30.8 | *** |
| **0.02 (Double)** | 55.6 | 54.4 | *** | 2872.8 | 45 | *** |

The cloacal fat pad measurements showed significant results between the treatments (df=4; F=7.87 and p<0.001).

However, the mean thickness of the control group was highest and that of chickens with the highest PE dose (0.02%) lowest. Tukey's HSD test showed that there was no significant difference in cloacal fat thickness between the control group and that of 0.5% PE.

Total abdominal pad fat was significantly highest in the control group compared with those with PE (df=4; p<0.001). Tukey's HDS test showed no difference in total abdominal fat mass between the control and 0.5% PE.

Pearson's product moment showed a strong negative correlation between total body abdominal pad fat and weight of chickens at 42 days (t = -18.2523, df = 123, p<0.001).

A linear regression line on a scatter plot showed strong negative correlation, R2=0.73 ($F_{(1,123)}$=333.1; p<0.001).

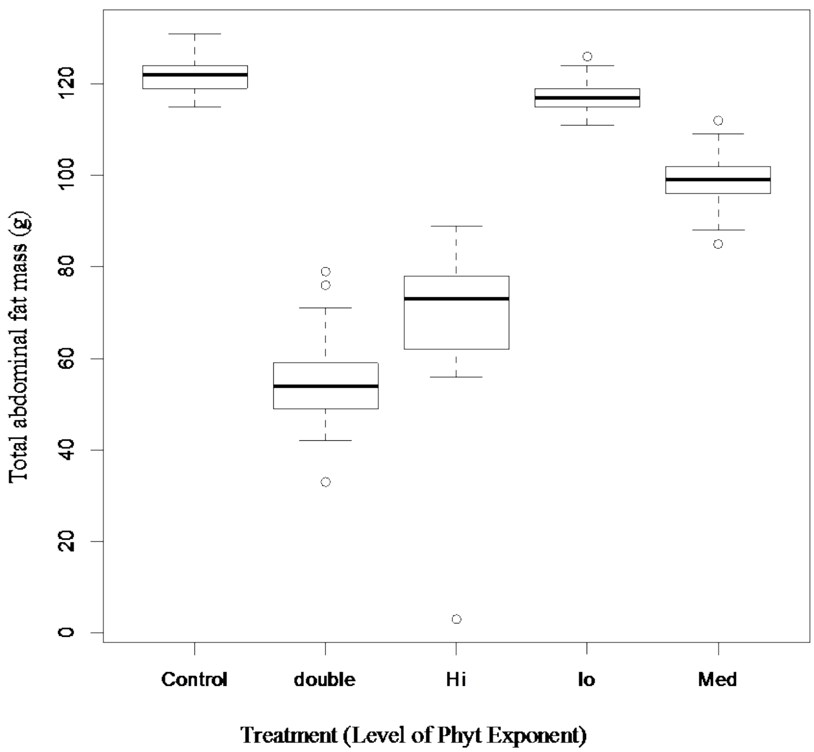


**Figure 1:** Impact of Phyt Exponent® on total abdominal Weight in broiler chickens

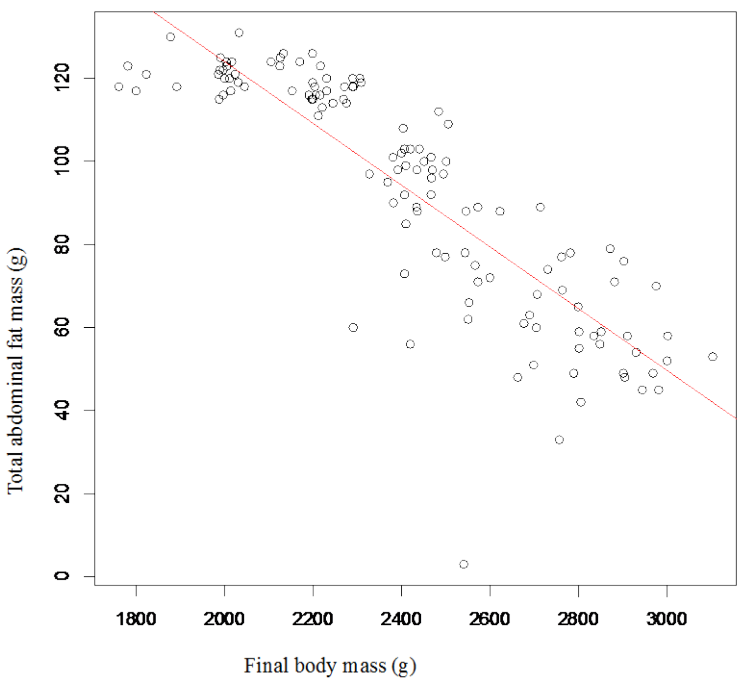


**Figure 2:** Relationship of total abdominal fat mass to total body weight of broiler chickens.

## 4. Discussion and Conclusions

Phyt [Exponent®] significantly decreased the accumulation of fat deposition in the abdominal pad and even leg muscles of the broiler chickens. Similarly, Reference [15] found that the inclusion of *Aspergillus awamori* at 0.05% was sufficient to induce a significant reduction in the abdominal fat percentage in poultry. Phyt [Exponent®] inhibited fat accumulation even at a very low dose of 0.005%. In addition the PE taken by the chickens in their early life continued to reduce the fat content and prevented mortality in the chickens. No deformities were noticed even if the chickens had large body weights in comparison to their ages. Phyt [Exponent®] possibly inhibited lipid biosynthesis and promoted fatty acid catabolism resulting in increased water uptake by the chickens. Chickens normally die after rapid accumulation of body weight due to a comparably reduced small heart and accumulation of fat around vital organs like the heart and the gizzard. An increase in body weight was accompanied by a decrease in abdominal fat resulting in large chickens with lean meat. The health benefit of lean is that it is a good source of protein with lower fat content and therefore low calories. [16] used chamomile flower extracts as feed additives on ducks and obtained similar results to those of the present study. *M.chamomilla* might have inhibitory effects on the broiler liver fatty acid synthesis. *M. chamomillla* could have also contributed substantially to increased weight gain in the chickens because the phytogenic substance has ability to increase digestibility of feed and improved microbial activity in the caecum [17]. Metabolic effects of *M. chamomilla* can be prolonged long after dosage [18].

Other phytogenic substances such as thyme [19] aloe [6,20] *Moringa oleifera* [21, 22, 23] have been used to improve growth performance and carcass quality and to some extent mortality on broiler chickens. For example, Thyme (*Thymus vulgaris*) is a medicinal herb that can be used as a natural alternative to antibiotics in poultry production [24] but it also has inhibitory effects on abdominal fat traits in broiler chickens [25, 19]. The use of phytogenic substances like aloe have a long history of use and are prevalent among animal producers who use it to alleviate disease incidence and as a substitute for AGPs. *Moringa oleifera* is now incorporated in poultry as well as other animal diets as a substitute for soya as well as its antimicrobial properties.

Botanical substances like PE have antimicrobial properties owing to the presence of *A. sativum*, *T. repens* and *V. tricolor*, which assist in suppression of microbial disease suppression by boosting the immune system of the birds. PE contains a significant amount of *E. purpurea*, which probably caused no mortality in chickens. However, the synergistic effect of the phytogenic substances in PE make very it suitable for use in animal production as it drastically cuts down the costs and frequency of use of the substances thereby reducing the cost of production.

Using PE, is therefore cost effective and less labour intensive. By only adding a few drops of PE in their drinking water, the chickens are further protected from diseases, are able to attain a very profitable body mass with lean meat. The results of this experiment suggest that a 0.015%PE is economically suitable to attain most desired quality disease free chicken. Due to its strong antimicrobial effects, PE can be used to combat bird flu worldwide allowing expansion of markets and production. The use of PE can be applied to other livestock however using the body weight of the animals although no detrimental effects have been found yet for overdose.

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